

**MANAGEMENT INFORMATION SYSTEMS 8/E**  
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**Data Communications**

# **Communication Basics**

- **Computer communications is at three levels**
  - **Application level**
  - **Computer level**
  - **Communication channel**
- **Protocol**
  - **Set of rules for communications**
  - **OSI Standard**

# OSI Reference Model

Layer	Name	Purpose
7	Application Layer	Application-to-application communication
6	Presentation Layer	Manage data representation conversions
5	Session Layer	Establish and maintain communication channel
4	Transport Layer	Guarantee end-to-end integrity of transmission
3	Network Layer	Route data between network addresses
2	Data Link Layer	Move data from one network address to another
1	Physical Layer	Put data onto and off of the network media

# ISO Website



# Protocols for Computer Communication

- Early computers
  - Terminals
  - Sneaker net
- System Network Architecture (SNA)
  - Established by IBM in 1974
  - Proprietary
- Token-Ring
  - Host computer controlled
  - peer-to-peer

# Protocols for Computer Communication

- Ethernet
  - Xerox working with Intel and Digital Equipment Corporation developed this protocol
  - Non-proprietary
  - Defined by IEEE
  - Works on a single transmission line
  - No token is passed

# Packets

- Piece of the total data to be communicated, combined with the address of the destination computer for the data and other control information.

Transmission Control Protocol/Internet Protocol (TCP/IP) is one of the more important packet switching protocols

# Network Addresses

- Address
  - Four-part set of numbers
  - Each from 0 to 255
- Internet Service Providers (ISPs)
  - User connects through common carrier
- Serial Line Internet Protocol (SLIP) and Point-to-Point Protocol (PPP)
  - Protocols for users at home



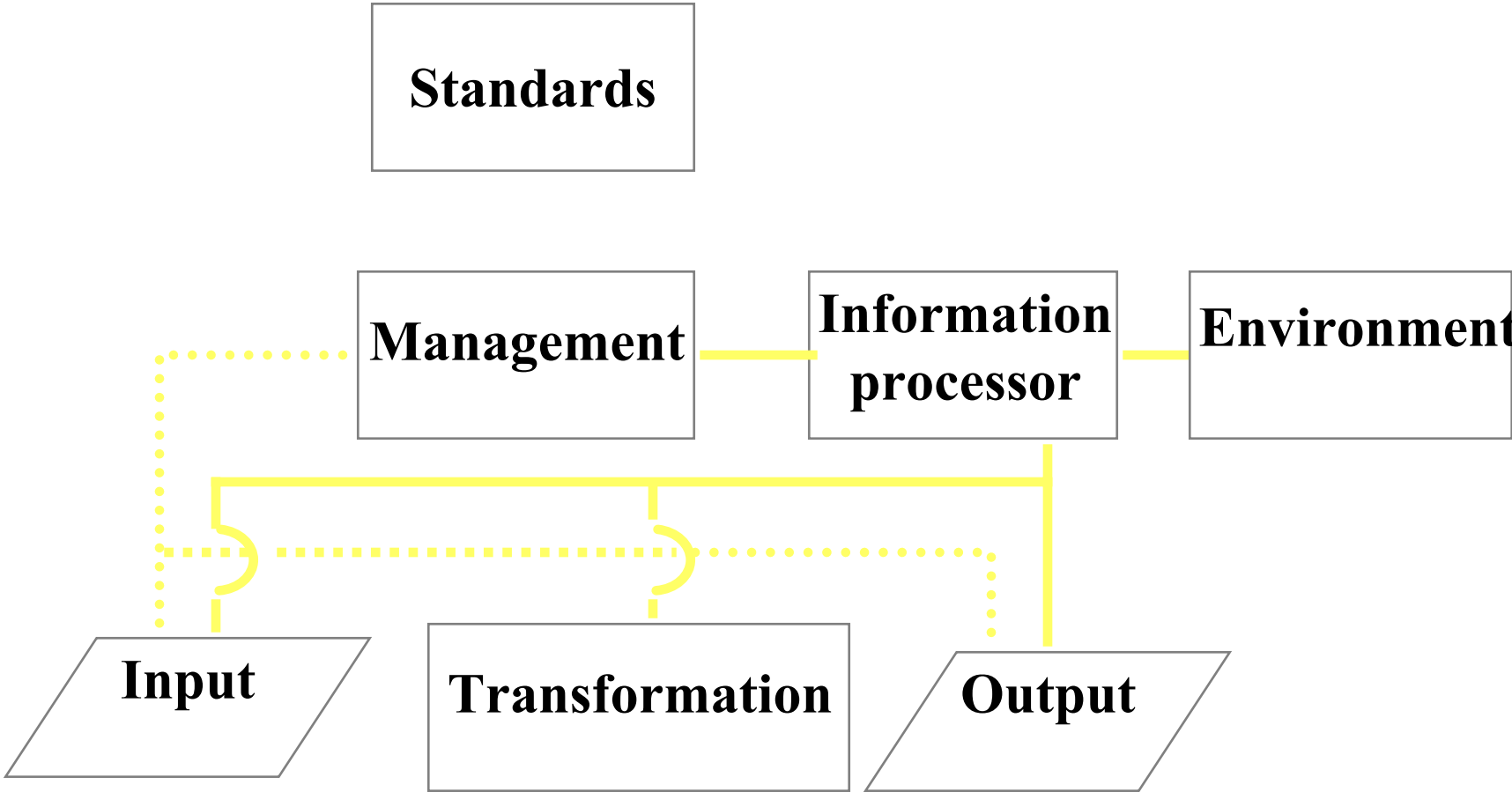
# Protocols for Public Phone Systems

- X.25
  - analog
  - older protocol
- Integrated Services Digital Network (ISDN)
  - Digital
  - Can carry voice, data, and video

# Protocols for Public Phone Systems (cont.)

- Frame Relays
  - Move to fiber optics
- Asynchronous Transfer Mode (ATM)
  - Smaller packet size
  - Faster transmission speeds

# Data Communications Links the General Systems Model Elements

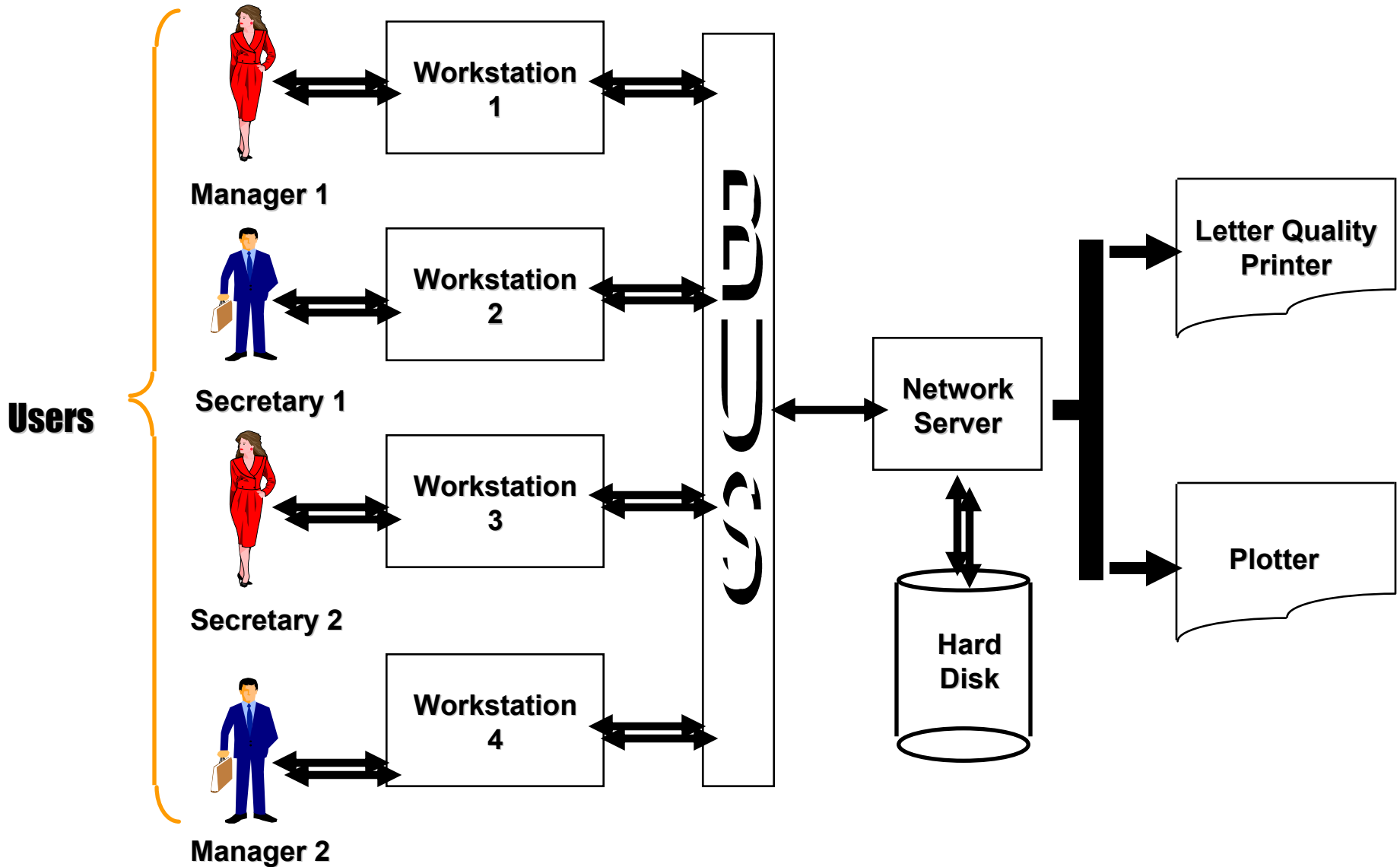


# Networks

- Each device must be connected to the communications medium via a network interface card (NIC)

# Types of Networks

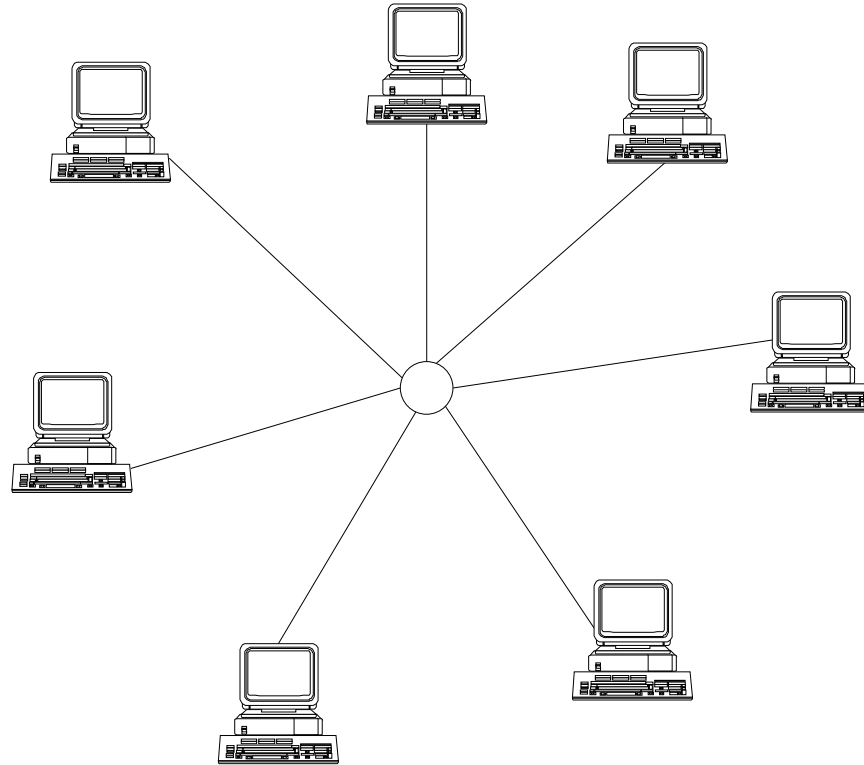
- LAN (local area network)
  - Limited area but could include 100 or so micros
  - Facilitates office automation
- MAN (metropolitan area networks)
  - spans one city/metropolitan area
- WAN (wide area network)
  - Covers a large geographic area
  - Includes a wide variety of circuits
  - Usually includes host computers



# A Local Area Network

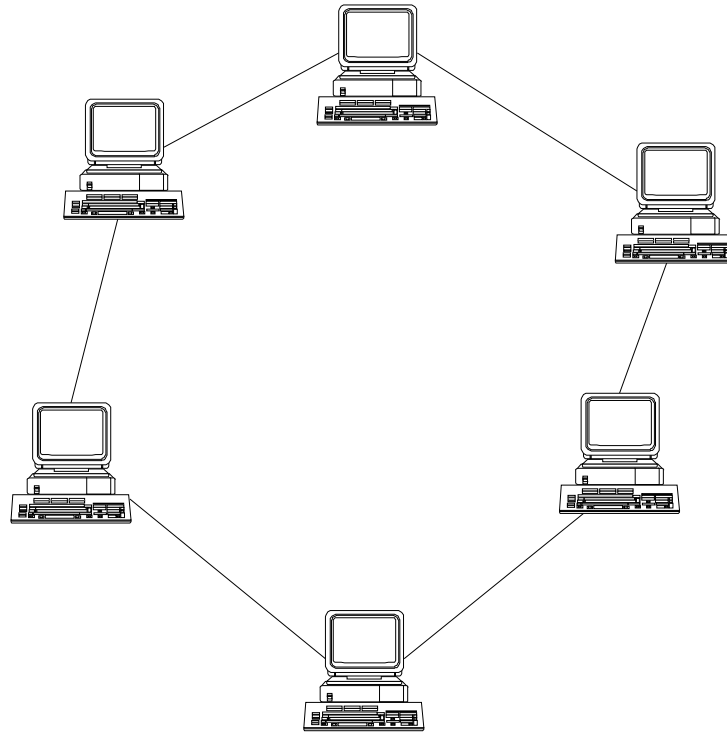
# Common LAN Topologies

## Star



# Common LAN Topologies

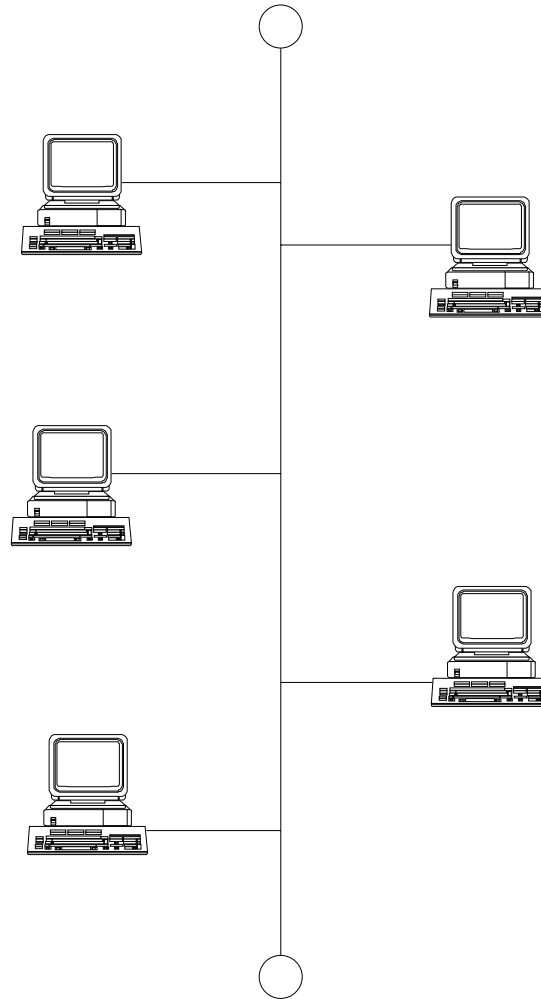
## Ring



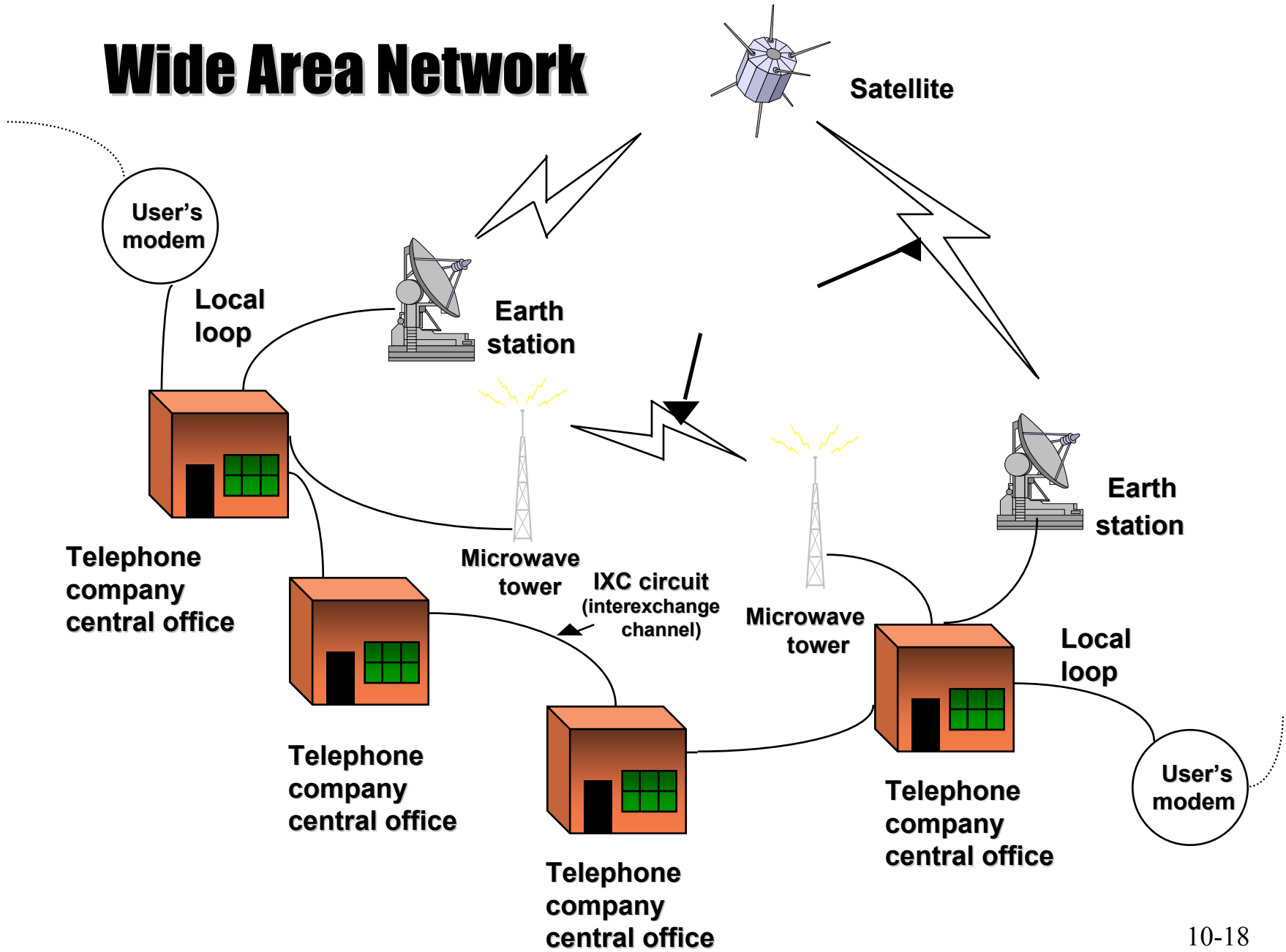


# Common LAN Topologies

## Bus



# Wide Area Network



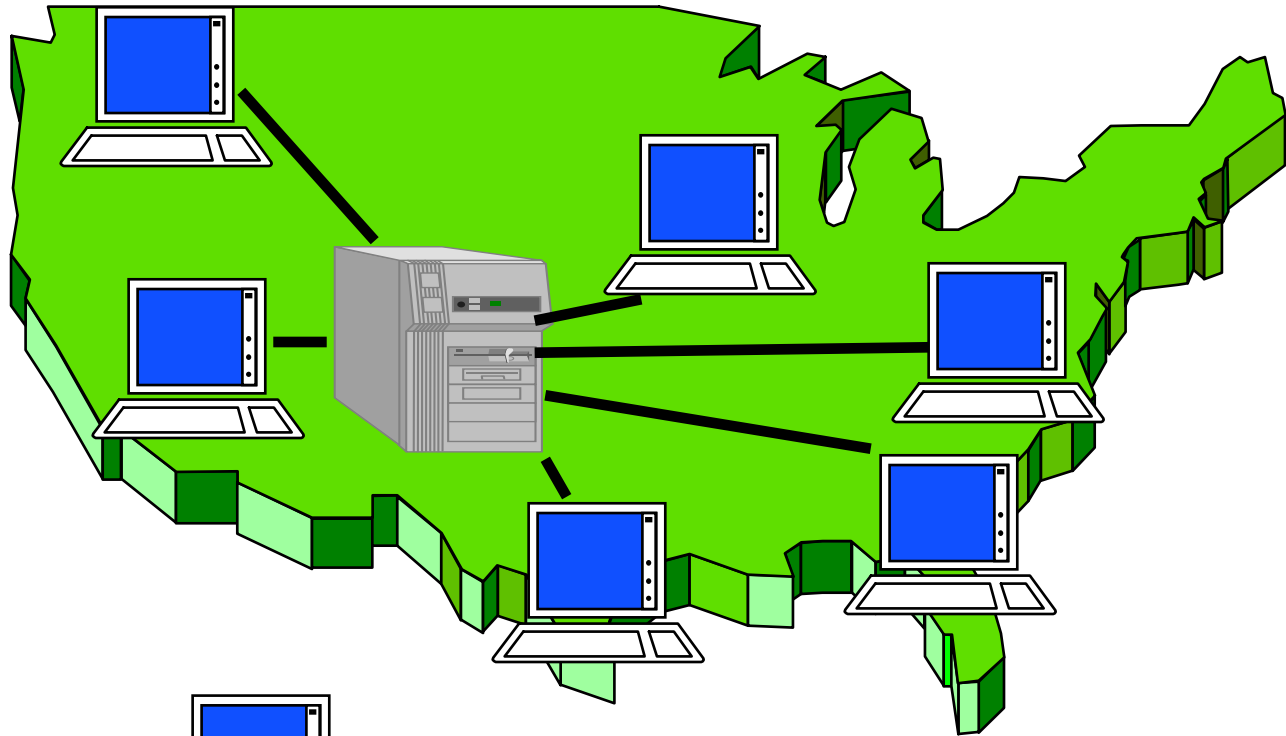
# Types of Networks (cont.)

- Collection of networks
- Public
- Intranet
  - Uses Internet network protocols
  - Limits accessibility
  - Firewall
- Extranet
  - For trusted business partners and customers

# Control of Data Communications Networks

- Centralized
  - Point-of-sale terminals
  - Data collection terminals
- Distributed processing
  - Receiving computer runs programs that use data
- Client/server processing
  - Mixes centralized and decentralized processing strategies

# A Network of Terminals



**Legend:**

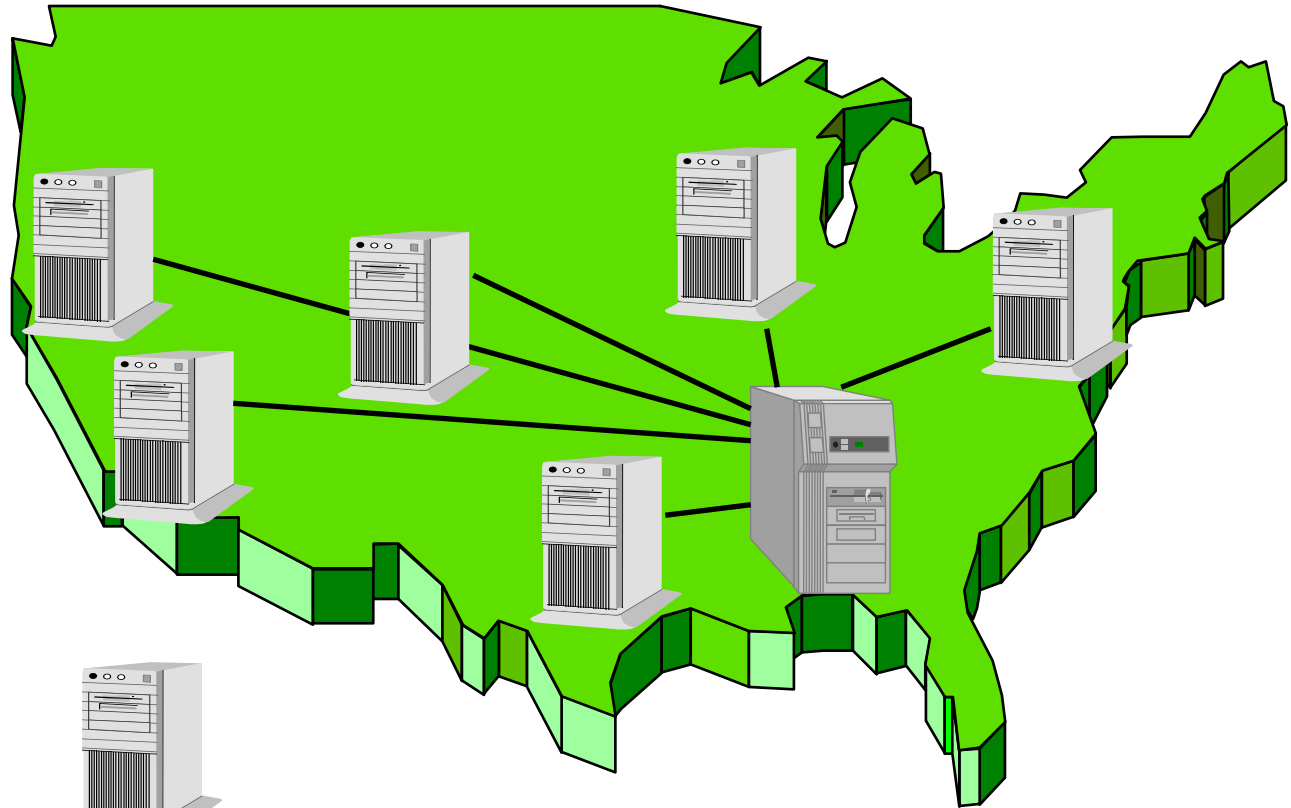


**Computer**



**Terminal**

# A Distributed Processing Network



**Legend:**



**Central  
Computer**

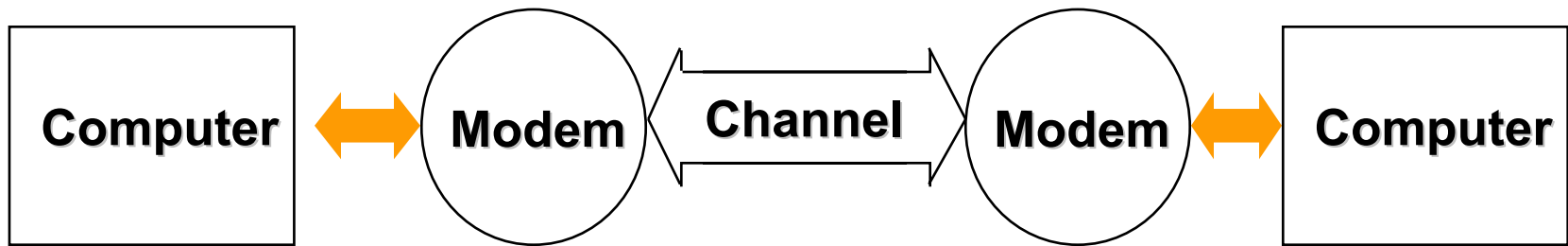


**Distributed  
Computer**

# Communications Hardware

- Modem
  - Converts digital to analog and vice versa
  - Bits per second determines transmission speed
  - Local loop
- Hub
  - Receives a data packet from a computer at one end of one spoke of the star topography and copies its contents to all other computers
  - Manageable hubs

# Data Communications with a Modem



A modem is always required between a telephone and a digital computer



# Communications Hardware (cont.)

- Router
  - Device that connects many LANs
  - More sophisticated than a bridge
  - Process header information of a packet
- Switch
  - Filters data not intended for a computer on a particular network

# Communications Connections

- Private Lines
  - Circuit that is always open to communications traffic
  - Also called leased line or dedicated line
  - Two types
    - T-1 - Maximum speed just over 1.5 Mbps
    - T-3 - Maximum speed 43 Mbps
    - Collections of 64 Kbps connections

# Communications Connections (cont.)

- Virtual Private Networks (VPNs)
  - Tunneling software makes Internet connections more secure
  - Privacy through authentication
  - More cost effective than private lines

# Network Management

- Digital nervous systems of an organization
- Network planning
  - Anticipates firm's network needs
  - Monitor's performance
- Network Control
  - Determines faults
    - Errors in data communication
    - Alerts to potential faults

# Network Management (cont.)

- Network manager
  - Planning, implementing, operating, and controlling a firm's data communications network(s)
- Staff
  - Network analysts (a type of systems analyst)
  - Software analysts
  - Data Communication Technicians (specialize in hardware)
  - LAN managers

# Wireless Networks

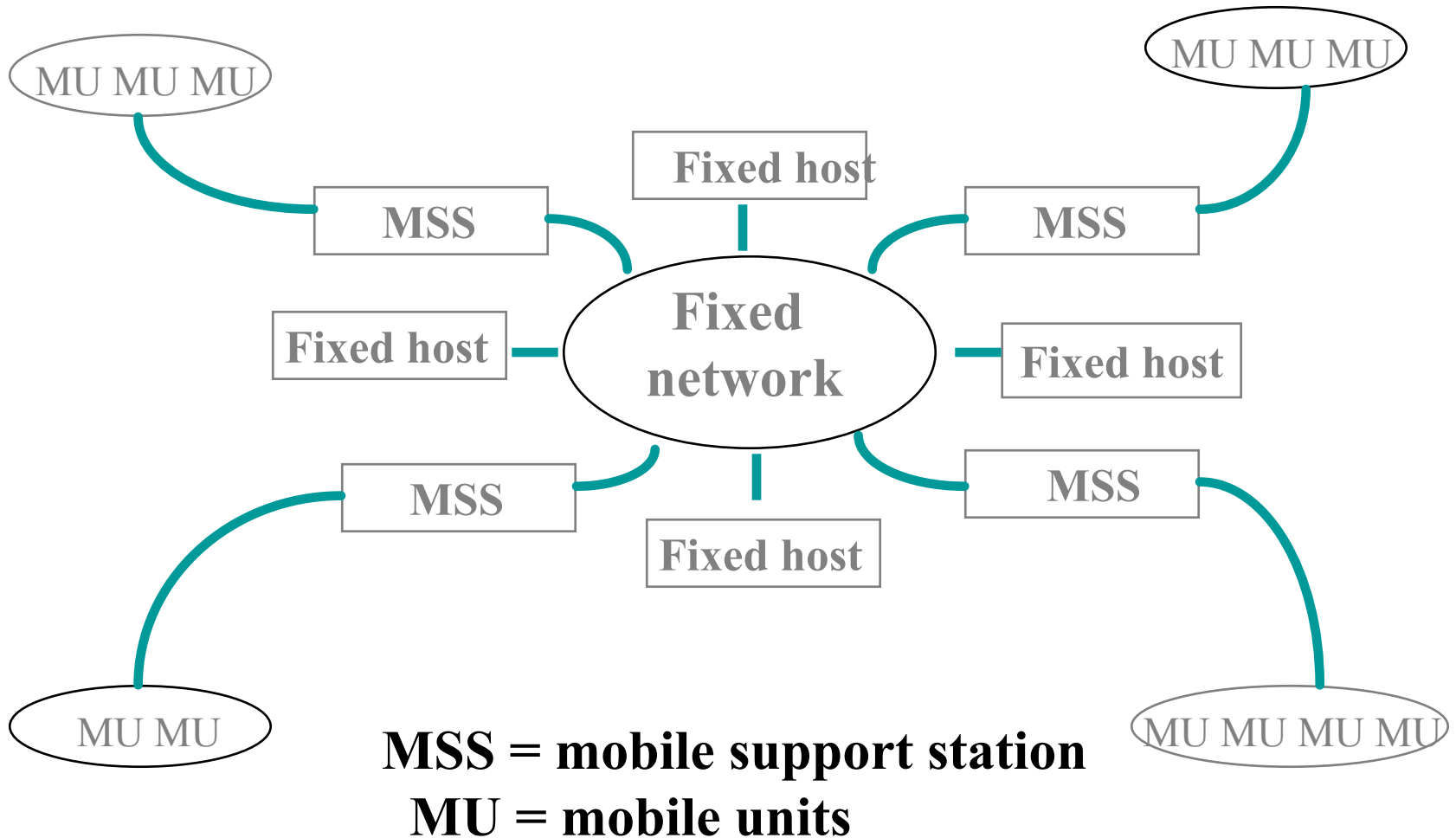
- Cellular networks
  - Hand held telephones
  - Primarily for voice
- Wireless LANs
  - Extensions of regular LANs
- Wide-area wireless networks
  - Nationwide

# Wireless Networks (cont.)

- Paging networks
  - Receive only capability

Personal Communications Network (PCN)  
is the networking infrastructure for wireless.  
It is not yet in place!

# A Network with Mobility Capability





# Summary

- Data communications enable computers to share information and applications
- Networks
  - LANs
  - MANs
  - WANs
- Communication standards

# Summary [cont.]

- Basic Hardware
  - Hubs
  - Routers
  - Bridges
  - Switches
- Planned growth